

## CLAIMS

1. A probe for detection and quantification of a lipid second messenger, which comprises:

5 a polypeptide specifically bound to the lipid second messenger, two chromophores respectively having different fluorescence wavelengths, wherein each of the chromophores is linked to each end of the polypeptide through a rigid linker sequence; and  
a membrane localization sequence linked to one of the chromophores  
10 through a rigid linker sequence.

2. The probe for detection and quantification of a lipid second messenger of claim 1, wherein the polypeptide specifically bound to the lipid second messenger is a lipid second messenger-binding protein.

15 3. The probe for detection and quantification of a lipid second messenger of claim 2, wherein the lipid second messenger-binding protein is a pleckstrin homology domain from GRP1.

20 4. The probe for detection and quantification of a lipid second messenger of any one of claims 1 to 3, wherein the chromophores are a cyan fluorescent protein linked to N-terminal end of the polypeptide and a yellow fluorescent protein linked to C-terminal end of the polypeptide.

25 5. The probe for detection and quantification of a lipid second messenger of any one of claims 1 to 4, wherein the linker sequence is a rigid  $\alpha$ -helix linker consisting of repeated sequences of SEQ ID NO: 1.

30 6. The probe for detection and quantification of a lipid second messenger of any one of claims 1 to 5, wherein at least one linker sequence has

a single di-glycine motif.

7. The probe for detection and quantification of a lipid second messenger of any one of claims 1 to 6, wherein the membrane localization sequence is a lipidized sequence or a transmembrane sequence.

8. A method for detecting and quantifying a lipid second messenger, which comprises:

co-existing the probe for detection and quantification of a lipid second messenger of any one of claims 1 to 7 with the lipid second messenger; and  
measuring changes in fluorescence spectra.

9. The method for detecting and quantifying a lipid second messenger according to claim 8, which comprises:

introducing a polynucleotide to express the probe for detection and quantification of a lipid second messenger of any one of claims 1 to 7 into cells; and

co-existing the probe with the lipid second messenger.

10. The method for detecting and quantifying a lipid second messenger according to claim 8, which comprises:

introducing a polynucleotide to express the probe for detection and quantification of a lipid second messenger of any one of claims 1 to 7 into a non-human totipotent cell; and

25 ontogenizing the cell to non-human animal, thereby co-existing the probe with the lipid second messenger in all cells of the animal or offspring animal.

11. The method for detecting and quantifying a lipid second messenger according to claim 9 to 10, wherein the probe for detection and

quantification of a lipid second messenger is fixed on membrane in the cells, and the lipid second messenger produced in the membrane is detected and quantified.

5           12.    A non-human animal or offspring animal thereof, which is obtained by:

introducing a polynucleotide to express the probe for detection and quantification of a lipid second messenger of any one of claims 1 to 7 into a non-human totipotent cell; and

10           ontogenizing the cell to the non-human animal.

13.    A method for screening a substance for quantifying a lipid second messenger, in the cells of the non-human animal or offspring animal thereof of claim 12, which comprise introducing a test sample into the 15 non-human animal or the offspring animal thereof.